REMARKS

In the Office Action, the abstract of disclosure was objected to. Claims 1 and 2 were rejected under 35 USC §112, second paragraph. Claims 1 and 2 were rejected under 35 USC §103(a) as being unpatentable over Ando et al in view of Kawashima.

In the present invention as defined in claim 1, electromagnet control means sets a target levitated position with respect to each of the control axes according to the following procedures (a) to (d). The phrase recited in original claim 1, line 22 to the end of the claim represents the following.

(a) Magnetically levitating the rotary body in the vicinity of one of limit portions in the direction of the control axis determined by mechanical restraining means, and getting a value A of an integral output which is the output of the integral operation unit when the rotary body is magnetically levitated as described above.

(b) Magnetically levitating the rotary body in the vicinity of the other limit portion in the direction of the control axis determined by mechanical restraining means, and getting a value B of an integral output which is the output of the integral operation unit when the rotary body is magnetically levitated as described above.

(c) Calculating a median C of the value A and value B as represented by the following formula.

$$C = (A + B)/2$$

(d) Setting the position of the rotary body corresponding to the median C as a target levitated position.

The phrase "an integral output which is the output of the integral operation unit when the rotary body is magnetically levitated in the vicinity of one of limit positions in the direction of the control axis determined by the mechanical restraining means" recited in original claim 1, from line 24 of page 46 to line 4 of page 47, represents the above-mentioned value A.

The phrase "an integral output of the integral operation unit when the rotary body is magnetically levitated in the vicinity of the other limit position" recited in original claim 1, from line 4 of page 47 to the end of the claim, represents the above-mentioned value B.

As described above, both of the values A and B are the output of the same integral operation unit. Incidentally, in FIG. 5 of the embodiment of the present invention, the integral unit is shown as reference numeral 40 and the output thereof is shown as Ici. However, as explained above, since the position of the rotary

body to be magnetically levitated differs when getting the values A and B, the value A is different from value B.

In (d) described above, the position of the rotary body corresponding to the median is detected by using the relation between the position of the rotary body and the integral output, which is previously detected. The relation between the position of the rotary body and the value of the integral output is stored in a memory when, for example, as recited in claim 2, the rotary body is gradually shifted from the vicinity of one limit position to the vicinity of the other limit position.

The present invention is characterized by the following points as apparent from the above explanation of claim 1.

Electromagnet control means calculates a median C of a value A of an integral output when the rotary body is magnetically levitated in the vicinity of one of limit positions and a value B of an integral output when the rotary body is magnetically levitated in the vicinity of the other limit position, and sets the position of the rotary body corresponding to the median C as a target levitated position of the rotary body.

The foregoing constitution enables the present invention to have an advantageous effect that the rotary body can be magnetically levitated approximately at a mechanical central position.

Ando describes the fundamental constitution of the magnetic bearing device of the present invention. However, Ando does not disclose the distinctive feature of the electromagnet control means of the present invention.

Magnetic bearing control apparatus (20, Figure 2) of Ando corresponds to electromagnet control means of the present invention, and reference position (Figure 4) of Ando corresponds to a target levitated position of the present invention.

However, Ando does not disclose how the magnetic bearing control apparatus (20, Figure 20) sets a target levitated position.

The Examiner indicates that the magnetic bearing control apparatus (20, Figure 20) comprises a target levitated position setting means (45, Figure 6).

The one indicated as the target levitated position setting means (45, Figure 6) by the Examiner is a micro-computer. As apparent from Figure 4 or Figure 6, micro-computer (45, Figure 6) is not included in the magnetic bearing control apparatus (20, Figure 2), but is disposed apart from the magnetic bearing control apparatus (20, Figure 2). Further, as apparent from the description of Ando, column 3, line 20 to column 4, line 41, the micro-computer (45, Figure 6) controls a servo-motor (26, Figure 4) and does not control the position of the rotary body. Namely, the micro-computer (45, Figure 6) does not control the electromagnet in

the magnetic bearing, and, therefore, does not set the target levitated position of the rotary body, either.

Kawashima discloses calculating a median C of the two positions A and B by using the following formula, and making the obtained median C a target levitated position.

$$C = (A + B)/2$$

As apparent from the description of Kawashima, column 2, line 59 to column 3, line 55, A is a position of rotor (1) where the rotor (1) comes in contact with one electromagnet (2b), and B is a position of rotor (1) where the rotor (1) comes in contact with the other electromagnet (2a). Therefore, the intermediate position C between A and B is not a mechanical central position, but a magnetic central position as they are called in the present invention.

Namely, Kawashima relates to magnetically levitating the rotary body at a magnetic central position by making a magnetic central position a target levitated position, and does not relate to magnetically levitating the rotary body approximately at a mechanical central position by setting a target levitated position, which is a distinctive feature of the present invention.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "Version With Markings To Show Changes Made".

Based on the foregoing amendments and remarks, it is respectfully submitted that the claims in the present application, as they now stand, patentably distinguish over the references cited and applied by the Examiner and are, therefore, in condition for allowance. A Notice of Allowance is in order, and such favorable action and reconsideration are respectfully requested.

However, if after reviewing the above amendments and remarks, the Examiner has any questions or comments, he is cordially invited to contact the undersigned attorneys.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE ABSTRACT:

Please amend the Abstract of the Disclosure as follows:

-- A magnetic bearing device ~~comprises~~ includes a pair of electromagnets holding a rotary body at opposite sides thereof in the direction of each of control axes, a detector for detecting the position of the rotary body, and an electromagnet controller having an integral operation unit for controlling the electromagnets based on the result of detection of the position. The electromagnet controller sets as a target levitated position of the rotary body the position of the rotary body corresponding to the median of an integral output of the integral operation unit when the rotary body is magnetically levitated in the vicinity of one of limit positions in the direction of the control axis determined by protective bearings and an integral output of the unit when the rotary body is magnetically levitated in the vicinity of the other limit position. --

IN THE CLAIMS:

Please amend claims 1 and 3 as follows:

1. (Amended) A magnetic bearing device for magnetically levitating a rotary body by contactlessly supporting the body with

magnetic attraction of pairs of electromagnets with respect to an axial direction and two radial directions orthogonal to each other and to the axial direction, the rotary body having movable ranges in the three supporting directions determined by mechanical restraining means, the magnetic bearing device ~~bearing characterized in that the device comprises~~ comprising: a pair of electromagnets ~~so~~ arranged ~~as~~ to hold the rotary body at opposite sides thereof in the direction of each of control axes in the respective three supporting directions, means for detecting the position of the rotary body in the direction of the control axis and electromagnet control means having at least an integral operation unit for controlling the electromagnets based on the result of detection of the position by the position detecting means, the electromagnet control means comprising: a target levitated position setting means for setting as a target levitated position of the rotary body in the direction of the control axis the position of the rotary body corresponding to ~~the~~ a median of an integral output which is the output of the integral operation unit when the rotary body is magnetically levitated in ~~the~~ a vicinity of one of limit positions in the direction of the control axis determined by the mechanical restraining means and ~~an~~ the integral output of the integral operation unit when the rotary body is magnetically levitated in ~~the~~ a vicinity of the other limit position.

2. (Amended) A magnetic bearing device according to claim 1 ~~which is characterized in that~~, wherein the target position setting means is adapted to position the rotary body at said one limit position, thereafter magnetically levitate the rotary body in the vicinity thereof, obtain the integral output at this time to store the output as a first limit position integral output in a memory, gradually shift the magnetically levitated position of the rotary body toward said other limit position, determine the position of the rotary body every time the rotary body is so shifted by a small distance at a time and ~~the~~ a corresponding integral output for storage as an intermediate position and an intermediate position integral output in the memory, move the rotary body to said other limit position, thereafter magnetically levitate the rotary body in the vicinity thereof, obtain the integral output at this time for use as a second limit position integral output, determine ~~the~~ a median of the first limit position integral output and the second limit position integral output, and select the output most proximate to ~~the~~ a median from among the intermediate position integral outputs stored in the memory to determine the intermediate position corresponding to the selected intermediate position integral output as the target levitated position.